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Civilian Radioactive Waste Management System
Management and Operating Contractor

Mined Geologic Disposal System (MGDS) Monitoring & Control Systems Centralization Technical Report

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1. Objective

The objective of this report is to identify and document Mined Geologic Disposal System (MGDS) requirements for centralized command and control. Additionally, to further develop the MGDS monitoring and control functions. This monitoring and control report provides the following information:

- Determines the applicable requirements for a monitoring and control system for repository operations and construction (excluding Performance Confirmation).

- Makes a determination as to whether or not centralized command and control is required.

2. Scope

The MGDS Monitoring and Control Systems Centralization Technical Report captures functions and requirements for the monitoring and control of the surface and subsurface systems. This report identifies and creates/develops functions to be monitored or controlled within the MGDS.

3. Quality Assurance

The Quality Assurance program applies to this analysis. The work reported in this document and outlined in TDPP B00000000-01717-4600-00104 helps to define what is necessary for the Yucca Mountain Site Characterization Project (YMP) in the area of command and control systems for the MGDS. This activity can affect the proper functioning of the MGDS, which includes the repository, surface buildings, etc. Many of the systems and subsystems potentially affected are important to waste isolation and safety. Control systems potentially affected by this analysis are are included in the Q-List (Ref. 5.1). The work performed for this analysis is covered by Procedure QAP-3-5, Development of Technical Documents.

4. Methodology

The methodology used in this report was to perform a thorough document review of various sources (including, but not limited to guides, regulations, Internet, and conceptual design documents) to identify requirements for a command and control system. After an extensive and thorough investigation into requirements for the MGDS, with little or no requirements directly applicable to this project, the subject was discussed with consultants from Beckman & Associates to take advantage of their knowledge of what the NRC expects to see in the area of command and control. It was verified that there is a significant amount of information regarding control and

monitoring of functions for Nuclear Power Plants, but little information on the MGDS. Through a series of brainstorming sessions with members of an Integrated Product Team (IPT) made up of Design Engineering and Systems Engineering personnel, a list of detailed functions to be monitored and controlled was created. It was then decided through expert analysis of the functions, which lower level functions were to be centralized. Due to the absence of any specific requirements for centralizing the monitor or the control functions, it was determined that letting the design engineering trade studies determine this was more appropriate.

5. References

5.1 "Yucca Mountain Project Site Characterization Q-List" YMP/90-55Q Rev. 5

5.2 "Mined Geologic Disposal System Functional Analysis Document" (FAD) B00000000-01717-1708-00006, Rev.01

5.3 "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" NUREG 0800 Chapter 7 ("Instrumentation &Controls Overview of Review Process") Draft 6/97

5.4 "Technical Guidance Document for License Application Preparation" YMP/97-03 Rev. 0

5.5 "Controlled Design Assumptions Document" B00000000-01717-4600-00032 Rev 04, ICN 3

5.6 "Preliminary Mined Geologic Disposal System Concept of Operations" B00000000-01717-4200-00004 Rev. 00

5.7 "Mined Geologic Disposal System Functional Analysis Document" B00000000-01717-1708-00006 Rev 01

5.8 "Reference Design Description for a Geologic Repository" B00000000-01717-5705-00002 Rev. 00

5.9 "Viability Assessment Design and Review Plan" B00000000-01717-4600-00070 Rev01, ICN 1

5.10 "Mined Geologic Disposal System Requirements Document" B00000000-00811-1708-00002 Rev 2

5.11 "Guidelines for Control Room Design Reviews" NUREG 0700 Sep 81

6. Analysis

6.1 Background

A search for centralized command and control requirements associated with the MGDS was performed. The sources included, but were not limited to:

6.1.1. Code of Federal Regulations (10 CFR60)
6.1.2 Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants Chapter 7 NUREG 0800 [Ref. 5.3]
6.1.3 Technical Guidance Document [Ref. 5.4]
6.1.4 Controlled Design Assumption (CDA) Document [Ref. 5.5]
6.1.5 10 CFR 50 Appendix A
6.1.6 Miscellaneous information from the Internet (NRC & DOE Home Pages)
6.1.7 Primary MGDS Conops [Ref. 5.6]
6.1.8 MGDS Functional Analysis Document (FAD) [Ref. 5.7]
6.1.9 Reference Design Description (RDD) [Ref. 5.8]
6.1.10 Viability Assessment Design Review Plan [Ref. 5.9]
6.1.11 MGDS Requirements Document (MGDSRD) [Ref. 5.10]
6.1.12 NUREG 0700 [Ref. 5.11]

These sources were investigated in an attempt to find stated requirements that verify the need for centralized monitoring and control of MGDS Functions. The System Description Document (SDD) calls for a central command and control system that will monitor the status of Repository operations and support systems. The central command and control system may be required, to maintain effective monitoring of overall site status, control primary functions associated with critical and safety related equipment, share information with the site operating stations and trend the primary site operating parameters in a way that supports improved operating methods.

This MGDS Monitoring and Control Systems Centralization Technical Report was to identify and document requirements for a central command and control facility. The search covered many sources and failed to come up with a requirement for a central control facility. The question regarding central versus non-central will now be decided through design trade studies to select the safest, most efficient, and reliable control and monitoring system.

6.2 MGDS Functions

The Functional Analysis Document (FAD) (Ref. 5.2) specifies the following fifth level functions which must be performed at the MGDS. The fifth level functions were identified as the key functions that correspond to the primary areas (noted in the parenthesis after the function) identified by the IPT for monitoring and control functions. These fifth level functions were then further developed by the IPT.

Protect environment (see Environmental, Section 6.3.5)
[Ref. 5.2, 1.4.3.1.1]

Protect against radiation (see Environmental, Section 6.3.5)
[Ref. 5.2, 1.4.3.1.2]

Protect nuclear material and Site from security threats (see Safeguards & Security, Section 6.3.1)
[Ref. 5.2, 1.4.3.1.3]

Protect personnel and property from safety hazards (see Safeguards & Security, Section 6.3.1)
[Ref. 5.2, 1.4.3.1.4]

Administrate and control site operations (see Emergency Response, Section 6.3.3)
[Ref. 5.2, 1.4.3.1.5]

Provide utilities (see Utilities, Section 6.3.4)
[Ref. 5.2, 1.4.3.1.8]

Provide heating, ventilation, and air conditioning (HVAC) (see Environmental, Section 6.3.5)
[Ref. 5.2, 1.4.3.1.9]

Protect from natural environment (see Environmental, Section 6.3.5)
[Ref. 5.2, 1.4.3.1.10]

Receive waste shipment (see Transportation, Section 6.3.2)
[Ref. 5.2, 1.4.3.2.1]

Prepare waste (see Surface, Section 6.3.6)

[Ref. 5.2, 1.4.3.2.2]

Emplace waste (see Surface, Section 6.3.6)

[Ref. 5.2, 1.4.3.2.3]

Retrieve waste (see Subsurface, Section 6.3.7)

[Ref. 5.2, 1.4.3.2.4]

Handle retrieved waste (see Surface, Section 6.3.6)

[Ref. 5.2, 1.4.3.2.5]

6.3 Command and Control Functions

Using functions from the FAD, the following lower level functions for monitoring and control were identified by the IPT. These are monitoring and control functions, but not necessarily functions that need to be centralized.

6.3.1 Safeguards & Security (S&S)

6.3.1.1 Provide the ability to determine the security status of the MGDS and location of personnel within controlled areas.

6.3.1.2 Provide the ability to determine the security status of the MGDS perimeter and controlled area.

6.3.1.3 Provide the ability to determine unauthorized intrusion for personnel who enter MGDS perimeter and controlled areas.

6.3.1.4 Provide the ability to account for all personnel within the MGDS.

6.3.1.5 Provide the ability to identify everyone entering the MGDS.

6.3.1.6 Provide the ability to maintain material control & accountability to ensure that materials are available when needed and hazardous materials are accounted for and properly controlled.

6.3.1.7 Provide the ability to monitor and react to airborne threats.

6.3.2 Transportation (dispatch)

General

6.3.2.1 Provide the ability to monitor off-site personnel when on site, personally owned vehicles (POV), and local area transportation to ensure only properly authorized vehicles and personnel are on site.

6.3.2.2 Provide the ability to status government MP vehicles, monitor traffic conditions, and monitor subsurface reviews/inspections to ensure only authorized personnel are on site and traffic is managed properly.

Construction & Development (on-site)

6.3.2.3 Provide the ability to monitor materials and personnel to ensure that only construction and development personnel and materials are in the construction and development areas.

6.3.2.4 Provide the ability to monitor surface and subsurface, construction performance to lessen the probability of schedule impacts.

Waste Handling

6.3.2.5 Provide waste tracking and accounting system.

6.3.2.6 Provide the ability to monitor subsurface waste transportation to ensure that all waste is transported properly to emplacement drifts.

6.3.2.7 Provide the ability to monitor and coordinate waste shipping and receipt schedules to ensure that all shipments are received.

6.3.2.8 Provide the ability to monitor locations and itineraries of

construction crews and inspectors so everyone can be located in case of emergency.

6.3.3 Emergency Response

6.3.3.1 Provide the ability to coordinate off-site response to ensure proper offsite support and response.

6.3.3.2 Provide the ability to monitor radiation alarms to ensure areas exceeding radiation limits are evacuated and off limits to personnel until the crisis is over.

6.3.3.3 Provide the capability to monitor security alarms to ensure no unauthorized personnel enter controlled areas.

6.3.3.4 Provide the capability to monitor fire protection systems to ensure all systems are operating properly and will be available to ensure quick and proper response and evacuation in the event of fires.

6.3.3.5 Provide the ability to monitor medical response to ensure that emergency medical treatment is available when needed.

6.3.3.6 Provide the capability to monitor natural environmental conditions to ensure preparation and planning for natural phenomenon that could potentially adversely affect the site and provide information to affected areas.

6.3.3.7 Provide the ability to monitor subsurface conditions to ensure management coordination or status of activities that cannot be easily accessed and to ensure continued safe operations underground.

6.3.3.8 Provide the ability to interface with other key systems (Safeguards & Security, Surface, Subsurface, Environmental, Utilities, etc.) to ensure better visibility and control of all areas.

6.3.3.9 Provide the ability to monitor and control post design basis

event (accident) response actions.

6.3.4 Utilities

Electric

6.3.4.1 Provide the ability to monitor electric load and use to ensure power is there when needed.

6.3.4.2 Provide the ability to monitor backup power status to ensure power is available if main power is lost.

Communications

6.3.4.3 Provide the ability to monitor and track all shipments of waste prior to arrival at the site.

6.3.4.4 Provide the ability to monitor site communications link to ensure availability of communications throughout the site.

6.3.4.5 Provide emergency communications so emergency conditions can be communicated to all personnel anywhere on site and off site.

6.3.5 Environmental

Natural environment

6.3.5.1 Provide the ability to monitor air, soil, water, and vegetation (sampling) to ensure that the project does no damage to the environment.

6.3.5.2 Provide the ability to monitor storm and weather conditions/warnings to ensure that precautions are taken to protect operations and personnel in the event of storms.

6.3.5.3 Provide the ability to monitor earthquakes to be able to react when one has occurred so management can check on damage, personnel, etc.

6.3.5.4 Provide the ability to monitor and maintain status of hazardous materials to ensure that they are accounted for and disposed of properly.

6.3.5.5 Provide the ability to monitor fuel to ensure availability for site operations.

6.3.5.6 Provide the ability to monitor sanitary waste to ensure proper disposal.

Surface

6.3.5.7 Provide the ability to monitor radiation levels to ensure worker and visitor safety

6.3.5.8 Provide the ability to monitor ventilation and air quality to ensure worker and visitor safety when in waste handling buildings.

6.3.5.9 Provide the ability to monitor effluents to be able to compare what has gone in and what has come out thereby tracking waste, fluids, etc. introduced into the environment.

Subsurface

6.3.5.10 Provide the ability to monitor flood control to ensure excess water doesn't travel underground.

6.3.5.11 Provide the ability to monitor radiation levels to ensure the safety of workers and visitors below the surface.

6.3.5.12 Provide the ability to monitor underground ventilation and air quality to ensure the safety of workers and visitors below the surface.

6.3.6 Surface

6.3.6.1 Provide the ability to monitor carrier /cask handling system to ensure safe/proper functioning.

6.3.6.2 Provide the ability to monitor canister and assembly transfer system to ensure safe/proper functioning.

6.3.6.4 Provide the ability to monitor Disposal Container (DC) handling system to ensure safe/proper functioning.

6.3.6.5 Provide the ability to monitor waste movement to ensure proper positioning, staging, and locations of the waste within the Waste Handling Building.

6.3.6.6 Provide the ability to monitor waste stored in the Waste Handling Building for criticality, inventory, and fuel condition.

6.3.6.7 Provide the ability to monitor empty carriers/shipping containers waiting to leave site for decontamination.

6.3.6.8 Provide the ability to monitor low-level waste.

Maintenance and supply system

6.3.6.9 Provide the ability to monitor equipment storage and supply system to ensure supplies and equipment availability when needed.

6.3.6.10 Provide the ability to monitor inventory planning and management system to ensure supplies and equipment, parts, etc., are available when needed.

6.3.7 Subsurface

6.3.7.1 Provide the ability to monitor transporter internal/external radiation to ensure containment of radiation and safety of the transporter before and after waste emplacement.

6.3.7.2 Provide the ability to monitor and control emplacement drift doors to ensure that they function properly and protect workers and visitors from radiation when they are underground.

6.3.7.3 Provide the ability to monitor emplacement gantry location to ensure that the gantry locates the disposal container properly in the emplacement drift.

6.3.7.4 Provide the ability to monitor subsurface temperatures and provide alarm for out of range condition, to ensure worker safety and comfort and proper operating conditions for equipment.

6.3.7.5 Provide the ability to monitor emplacement/development interfaces to ensure positive airflow from the development side to the emplacement side when waste is present in the emplacement side.

6.3.7.6 Provide the ability to monitor and control rail switch status to ensure proper routing of the emplacement gantry.

6.3.7.7 Provide the ability to monitor development activities to ensure availability of emplacement locations when needed to be able to accept wastes when necessary.

7. Summary and Conclusions

There were no requirements found for this project or other waste disposal projects that require a command and control facility to be centralized. It may be a good idea from an efficiency point of view, but that will have to be determined by design trade studies and a disciplined, well thought out design plan. The functions the IPT identified are lower level functions and should be considered for inclusion in either an update to the FAD, and/or incorporated into the appropriate SDD (if applicable).

8. Acronyms & Abbreviations

ACD	Advanced Conceptual Design
CDA	Controlled Design Assumptions
CFR	Code of Federal Regulations
CRWMS	Civilian Radioactive Waste Management System
DI	Document Identifier
FAD	Functional Analysis Document
HVAC	Heating, Ventilation, & Air Conditioning
IPT	Integrated Product Team
MGDS	Mined Geologic Disposal System
MP	Motor Pool
NRC	Nuclear Regulatory Commission
NUREGs	Nuclear Regulations
POV	Personally owned vehicle
QAP	Quality Administrative Procedure
Q-List	Quality Items List
S&S	Safeguards and Security(this list needs to be edited.)
TDPP	Technical Data Preparation Plan
YMP	Yucca Mountain Site Characterization